Salmonella enterica in Alberta Slaughter Hogs

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Summary: Cecal samples were collected and cultured to determine the occurrence of *Salmonella* spp. in Alberta slaughter hogs. *Salmonella enterica* subsp. *enterica* was recovered from 211/602 samples yielding 282 individual isolates distributed among 37 serotypes. The 5 most common serotypes (California, Infantis, Derby, Mbandanka and Worthington) comprised 68.4% of all isolates. Resistance to tetracycline, streptomycin, and sulfamethoxazole, were commonly identified. Resistance to 5 or more antibiotics was noted in 9.6% of all isolates, and only in serotypes Agona, California, Derby, Typhimurium var. Copenhagen DT104, and Worthington. This study has shown that 35% of Alberta slaughter hogs carry *S. enterica* subsp. *enterica*. Resistance by *Salmonella* spp. isolates to streptomycin, sulfamethoxazole and tetracycline, singly or in combination, was relatively frequent but multi-resistant isolates were less common.

Keywords: swine, cecal, serotype, MIC, multi-resistant

Introduction: Pork has been reported to be associated with as much as 15% of human cases of salmonellosis (quoted in Borch *et al.*, 1996). Berends *et al.*, (1997) estimated that 70% of carcass contamination resulted from infected hogs and that a *Salmonella* spp. positive hog is 3-4 times more likely to result in a*Salmonella* spp. positive carcass. The emergence, and increasing prevalence, of multi-drug resistant salmonellae such as *S. enterica* subsp. *enterica* ser. Typhimurium DT104 (Glynn *et al.*, 1998, Poppe *et al.*, 1998) and other antibiotic resistant strains (Davis *et al.*, 1999) has intensified the need to control salmonellae at all levels of the food chain. This project was initiated to determine the*Salmonella* spp. status of Alberta slaughter hogs, the serotypes present, and their antimicrobial resistance profiles.

Materials and Methods: Six hundred and two (602) cecal samples were collected from Alberta slaughter hogs in 1999. A 5 g aliquot of each sample was cultured for *Salmonella* spp. by two selective enrichment pathways. Presumptive *Salmonella* spp. colonies were confirmed by Salmonella Poly O/O1 antiserum agglutination. Two confirmed *Salmonella* spp. isolates from each positive sample

were serotyped and tested for antibiotic susceptibility (minimum inhibitory concentration, MIC) using a custom MIC Panel. An isolate was considered resistant if resistance to 1 or more antibiotics was detected.

Results: *Salmonella enterica* subsp. *enterica* was isolated from 211/602 (35%) cecal samples. In total, 282 discrete isolates were identified from 37 serotypes (Table 1). Five serotypes (California, Infantis, Derby, Mbandanka, Worthington) comprised 68.4% (193/282) of all isolates. Resistance to at least one antibiotic was seen in 60.3% of isolates (Table 1). One hundred three isolates were sensitive to all antibiotics in the test panel and 9 other isolates displayed intermediate sensitivity to 1 or 2 antibiotics. Only 6 serotypes had no resistant isolates. Isolates were most commonly resistant to tetracycline (48.9%) followed by streptomycin (36.2%) and sulfamethoxazole (35.8%). Resistance to ampicillin, ticarcillin and other antibiotics were detected at lower frequencies. All isolates identified were sensitive to amikacin, ceftiofur, ciprofloxacin, naladixic acid, and trimethoprim/sulfamethoxazole. No isolates were resistant apramycin but 2 isolates displayed intermediate sensitivity. Sixty-four (22.7%) isolates were resistant to a single antibiotic while 79 (28.0%) were resistant to 2-4 antibiotics. Resistance to 5 or more antibiotics was identified in 27 (9.6%) isolates from 5 serotypes (Agona, California, Derby, Typhimurium var. Copenhagen, Worthington). The majority of these isolates (20/27) were serotypes California or Typhimurium var. Copenhagen DT104 (Table 1).

Discussion: It has been estimated that one third of human food borne disease is due to *Salmonella* spp. (NAHMS, 1994) and the incidence of salmonellosis is increasing in industrialized countries (Gomez et al., 1997). In addition, the emergence of penta-resistant *S.* ser. Typhimurium DT104 has intensified the need to control *Salmonella* spp. contamination of the food supply. Berends et al. (1997) showed that the presence of *Salmonella* spp. in the incoming swine is an important factor in the risk of contamination of the resulting carcass. This study has shown that a significant proportion of Alberta swine carry *Salmonella* spp. at slaughter. The penta-resistant phenotype was present in 9.6% of hogs. Resistance to tetracycline, streptomycin and sulfemethoxasole was relatively common. The findings are similar to resistance levels reported for the U.S.A. (Fedorka-Cray *et al.*, 1998).

Table 1: The serotypes of *Salmonella enterica* subsp. *enterica* isolated from Alberta slaughter swine. * ≥1 - indicates all resistant isolates; ≥3 – indicates all multi-resistant isolates; ≥5 – indicates isolates resistant to 5 or more antibiotics.

Salmonella enterica subsp. *enterica* Serotypes	Number of Times Isolated (%)	Number of Resistant Isolates* (≥1, ≥3, ≥5)
California	56 (19.9)	33, 19, 12
Infantis	54 (19.1)	10, 1, 0
Derby	44 (15.6)	37, 27, 1
Mbandaka	23 (8.2)	23, 13, 0
Worthington	16 (5.7)	12, , 1
Agona	10 (3.5)	9, 8, 5
Typhimurium var. Copenhagen DT104	10 (3.5)	9, 8, 8
Typhimurium	6 (2.1)	1, 0, 0
Heidelberg DT6	5 (1.8)	2, 1, 0
Orion	5 (1.8)	5, 0, 0

Salmonella enterica subsp. *enterica* Serotypes	Number of Times Isolated (%)	Number of Resistant Isolates* (≥1, ≥3, ≥5)
Typhimurium DT104	5 (1.8)	3, 0, 0
Typhimiurium var. Copenhagen	5 (1.8)	4, 0, 0
Anatum	4 (1.4)	4, 0, 0
Tennessee	4 (1.4)	1, 0, 0
Bovismorbificans	3 (1.1)	1, 0, 0
Enteritidis DT8	3 (1.1)	1, 0, 0
London	3 (1.1)	1, 0, 0
Rubislaw	3 (1.1)	1, 1, 0
19 subtypes each with <3 isolates	23 (8.2)	13, 5, 0
Totals	282 (100)	170, 84, 27

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